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PERCH SITES AND FOOD OF ADULT CHINESE MANTIDS (DICTYOPTERA: MANTIDAE)

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Abstract.—In old fields, most adult Chinese mantids, *Tenodera aridifolia sinensis,* used *Cirsium vulgare* or *Solidago* spp. as perch sites, usually being in the upper branches of these plants. In these fields and in a suburban garden, their prey included *Apis mellifera, Bombus* sp., *Chauliognathus pennsylvanicus, Danaus plexippus, Gryllus* sp., *Melanoplus* sp., *Papilio glaucus, Polistes fuscatus,* and *Xylocopa virginica.* In the laboratory, most female mantids that ate possibly toxic *D. plexippus,* in addition to crickets, produced viable young.

The Chinese mantid, *Tenodera aridifolia sinensis* Saussure, was introduced into the United States in the vicinity of Philadelphia, Pennsylvania, about 70 yr ago (Borror et al., 1981). Hadden (1927) published a list of 21 insect species eaten by this mantid, but he did not state whether his observations were made in the field or laboratory. Johnson (1976) reported the capture and consumption of a *Trionyx* soft-shelled turtle by this insect in the laboratory. Hurd et al. (1978) studied the relationships between density, maturation, and mortality, and Nickle and Harper (1982) studied the predation of a *Peromyscus* mouse by a Chinese mantid.

My investigation concerns perch locations of adult Chinese mantids and some of the foods that they consumed in old fields and in a suburban flower and vegetable garden. There appear to be no published field reports of these subjects for this mantid species, and published information on them in the hundreds of other species of mantids is fragmentary (Barrows, 1982).

Materials and Methods

Mantids were studied in old fields in Reston, Virginia, and in a suburban vegetable and flower garden in Glen Echo, Maryland, in September and October, 1980–1983. Mantids were located in the fields by examining plants, especially those in flower. The kinds of foods that mantids were seen consuming, the plants on which they perched, and their approximate heights on plants (estimated to the nearest ⅓ m) were recorded. Also, I searched the ground beneath each mantid for any insect parts that they might have dropped. In mid-September, 1982, to increase mantid density and my chances of seeing them feed, 17 field-collected adult mantids (5 males and 12 females) were released in my flower and vegetable garden in Glen Echo.

In addition, 10 field-collected female mantids were maintained in separate 4.2-liter jars in the laboratory. Each was fed two adult monarch butterflies, *Danaus plexippus* L., and as many house crickets, *Acheta domestica* L., as she would eat.

Table 1. Perch sites of 38 mantids in Reston, Virginia (1980–1982). All plants were in full bloom, except Poaceae and *L. tulipifera*.

Plants	Perch heights in meters (mean ± 1 SE, range, N)	
	Males	Females
Ambrosia trifida L., giant ragweed	2.0 ± 0, 0, 1	—
Bidens aristosa (Michx.) Britt., tickseed-sunflower	—	1.7 ± 0, 0, 2
Cirsium vulgare (Savi) Tenore, bull thistle	0.8 ± 0.08, 0.7–1, 3[a]	1.1 ± 0.07, 0.3–1.7, 19[a]
Liriodendron tulipifera L., tulip tree	0.7 ± 0, 0, 1	0.7 ± 0, 0, 2
Poaceae, grass	0.3 ± 0, 0, 2	0 ± 0, 0, 1
Senecio vulgaris L., common groundsel	—	1.7 ± 0, 0, 1
Solidago spp., goldenrod	0.9 ± 0.09, 0.7–1.3, 4[b]	0.9 ± 0.06, 0.7–1.3, 12[b]

[a] One of these mantids was in copula.
[b] Two of these mantids were in copula.

Egg cases produced by these females were stored in individual plastic bags with air holes, and I noted whether nymphs hatched from the cases. The Statistical Analysis System computer package (Ray, 1982) was used to analyze data with the Fisher exact probability test (FEPT) and the *t*-test corrected for heteroscedasticity (TT).

Results and Discussion

Perch locations.—In September in Reston, 50 mantids perched on or near the fully-blooming flowers of plants representative of five genera and on the leafy shoots of plants in two other genera (Table 1). Eighty percent of the mantids were on *Cirsium vulgare* (Savi) Tenore and *Solidago* spp., suggesting that these plants were the best ambush sites for prey that were probably attracted to the flowers. For unknown reasons, mantids were not found on other common plants in bloom at the time such as *Eupatorium purpureum* L., *E. coelestinum* L., *Gnaphalium obtusifolium* L., *Impatiens capensis* Meerb., and *Vernonia noveboracensis* (L.) Michx. Heights of *E. purpureum, I. capensis,* and *V. noveboracensis* were within the height ranges of *C. vulgare* and *Solidago* spp. Females on *Liriodendron* saplings were likely to have been feeding, searching for oviposition sites, or both. Oothecae were found on these saplings. Heights of mantid perches are also given in Table 1. Perches were usually on the highest branches, but not the highest points of herbaceous plants.

Since males fly in the field and they approach females, rather than vice versa, prior to mating under laboratory conditions (pers. obs.), I hypothesized that males choose higher perches than females. Higher sites might be better lookout and takeoff places for these large, heavy male insects. However, 13 males perched 0.9 ± 0.12 SE (0.3–2.0) m above the ground which was not significantly different from 37 females' perch heights of 1.0 ± 0.06 (0–1.7) m above the ground ($P = 0.1585$, TT), not supporting my supposition.

Prey.—During field observations, I found two female mantids eating red-legged grasshoppers, *Melanoplus* sp.; two females eating bumble bees, *Bombus* sp.; one female eating a soldier beetle, *Chauliognathus pennsylvanicus* (DeGeer); and one female eating a male monarch, *Danaus plexippus* L. Insect parts found on plants

or on the ground directly below mantids indicated that 12 other mantids ate 2.3 ± 0.64 (1–8) monarchs, and one other mantid ate one bumble bee. Most instances of mantids eating monarchs were seen in 1980. Seventy-six percent of 37 monarchs consumed were males based on my observations of mantids eating monarchs and counts of wings found beneath mantids and on the ground below mantid perches. In addition to monarch wings, I found part of a monarch abdomen below eight of 20 mantid perches. Wings of one male and three female tiger swallowtails, *Papilio glaucus* L., were also found among one group of monarch wings. In Glen Echo, I observed mantids eating one paper wasp, *Polistes fuscatus* (F.); one honey bee, *Apis mellifera* L.; one cricket, *Gryllus* sp.; one carpenter bee, *Xylocopa virginica* L.; and one conspecific female mantid.

Because part of a monarch abdomen was found below some mantids and monarchs are distasteful and toxic to birds (Brower and Glazier, 1975), I tested the hypotheses that mantids also find monarch abdomens distasteful and, further, eating them decreases their egg viability. In three of 10 mantids that I observed feeding on living monarchs in the laboratory, a mantid that started eating a monarch abdomen quickly moved her forelegs downward from her mouth and dropped the abdomen, as if it were distasteful. However, in the remaining seven cases, mantids ate entire monarch abdomens.

Nine of these 10 female mantids that ate crickets and parts of or whole bodies of two monarchs in the laboratory produced eggs which hatched into apparently normal, mobile nymphs. The eggs of the tenth mantid did not hatch. This frequency of viable offspring is significantly different from a hypothetical case in which none of 10 females produce viable offspring ($P = 0.001$, FEPT), indicating that their consumption of monarchs did not stop them from producing viable young. Thus, if the monarchs were toxic, they were not poisonous enough to hinder viable egg production.

To my knowledge, only Gelperin (1968) previously conducted a laboratory study of Chinese mantid feeding on aposematically colored, possibly distasteful and toxic prey. Inexperienced mantids struck at, captured, tasted, and discarded milkweed bugs, *Oncopeltus fasciatus* (Dallas), which are orange and black like the monarch. But after experience in tasting these bugs, only sufficiently starved mantids ate them and his mantids, like mine, did not show symptoms of poisoning.

The mantid cannibalism mentioned above occurred when one female mantid ate most of another female several days after I introduced 17 adult mantids into my garden, placing them all on a 3-m tall *Thuja* tree. This cannibalism may have occurred because the mantids were unusually concentrated on this one plant, food was limited, or both. Cannibalism in the Chinese mantid has been noted previously (Didlake, 1926; Hadden, 1927; Hurd et al., 1978). Nymphs in the laboratory practiced cannibalism infrequently except when they were deprived of an alternative food source (Hurd et al., 1978). In the old fields, I did not see adult mantids of the same sex closer than 1 m to each other. The dispersion may have resulted from behaviors such as cannibalism earlier in the season and intrasexual repulsion among mantids.

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Literature Cited

Barrows, E. M. 1982. Observation, description, and quantification of behavior: A study of praying mantids, pp. 8–20 and 242–246. *In* J. R. and R. W. Matthews, Insect Behavior. A Sourcebook of Laboratory and Field Excercises. Westview Press, Boulder, CO. 324 pp.

Borror, D. J., D. M. DeLong, and C. A. Triplehorn. 1981. An Introduction to the Study of Insects. Fifth Edition. Saunders College Publ., New York, NY. 923 pp.

Brower, L. P. and S. C. Glazier. 1975. Localization of heart poisons in the monarch butterfly. Science 188: 19–25.

Didlake, M. 1926. Observations on the life-histories of two species of praying mantis (Orthopt.: Mantidae). Entomol. News 37: 169–174.

Gelperin, A. 1968. Feeding behaviour of the praying mantis: A learned modification. Nature 219: 399–400.

Hadden, F. C. 1927. A list of insects eaten by the mantis *Paratenodera sinensis* (Sauss.). Proc. Hawaii. Entomol. Soc. 6: 385.

Hurd, L. E., R. M. Eisenberg, and J. O. Washburn. 1978. Effects of experimentally manipulated density on field populations of the Chinese mantis (*Tenodera ardifolia* [sic] *sinensis* Saussure). Am. Midl. Nat. 99: 58–64.

Johnson, M. D. 1976. Concerning the feeding habits of the praying mantis *Tenodera aridifolia sinensis* Saussure. J. Kans. Entomol. Soc. 49: 164.

Nickle, D. A. and J. Harper. 1981. Predation on a mouse by the Chinese mantid *Tenodera aridifolia sinensis* Saussure (Dictyoptera: Mantoidea). Proc. Entomol. Soc. Wash. 83: 801–802.

Ray, A. A. 1982. SAS User's Guide, Basics, 1982 Edition. SAS Institute, Inc., Cary, NC. 923 pp.